

Reports of metaldehyde and iron phosphate exposures in animals and suspected iron toxicosis in dogs

JAVMA, Vol. 242, No. 9, May 1, 2013



Kaci J. Buhl, MS; Frederick W. Berman, DVM, PhD; David L. Stone, PhD; Department of Environmental & Molecular Toxicology

SLUG & SNAIL CONTROL

In the United States, slugs are most prevalent in the southern states, the Hawaiian Islands and the Pacific coast. Slugs and snails cause damage to agricultural crops and home gardens, especially in no-till cropping systems. Molluscicides are pesticides designed to kill slugs and snails. A limited number of active ingredients are available for this use in residential settings in the United States. Two of the most common are metaldehyde and iron phosphate.

HISTORY OF PET POISONING

Metaldehyde is both attractive and toxic to dogs. Formulators add food processing by-products (i.e. molasses) in order to make the baits more attractive to slugs and snails. Dogs tend to eat all of the bait available, even digging to retrieve buried bait applications. Typically, acute exposure to metaldehyde requires immediate treatment. Metaldehyde stimulates the central nervous system after crossing the blood-brain barrier. It causes severe muscle tremors, hyperthermia, and metabolic acidosis. Within three hours of ingestion, initial signs include increased heart rate, anxiety, stiff legs, hypersalivation, and ataxia. Vomiting, hyperthermia, and muscle tremors may follow rapidly, and later stages are characterized by depression and necrosis. There is no antidote for metaldehyde poisoning. Animals that survive the first 24 hours may develop liver failure after 2-3 days. Temporary blindness may also develop.¹

Iron phosphate-containing products for slug and snail control are marketed as safer alternatives to products containing metaldehyde, and 28 iron phosphate-containing molluscicides are currently registered with the EPA.² Canine iron toxicosis has been well-described in relation to dietary supplements and iron-fortified fertilizers. **To date, only one clinical report, describing five cases of iron toxicosis in dogs, has been published in relation to iron-containing baits for slugs and snails.**³ In that report, the dogs ingested bait containing iron EDTA, rather than iron phosphate. The bioavailability of iron in foods is increased three-fold when administered at a molar ratio (EDTA:Fe) of 0.5:1.⁴ Although it is not required to be identified on the product label, EDTA appears to be included in multiple iron phosphate-containing molluscicides in the United States.^{5,6}



Figure 1. Examples of product labels from molluscicides containing 1% iron phosphate. Photo credit: K. Buhl

References

- 1) Steenberg, Vera M. Taking the Bait: Metaldehyde Toxicosis. *Veterinary Technician* 2004; April.
- 2) US Environmental Protection Agency. Pesticide product information system. Available at: <http://www.epa.gov/opp00001/PPIsdata>. Accessed February 20, 2012.
- 3) Haldane SL, Davis RM. Acute toxicity in five dogs after ingestion of a commercial snail and slug bait containing iron EDTA. *Aust Vet J* 2009; 87:284-286.
- 4) MacPhail AP, Patel RC, Bothwell TH, et al. EDTA and the absorption of iron from food. *Am J Clin Nutr* 1994; 59:644-8.
- 5) Wilson, C. Statement in support of continued listing of ferric phosphate as a molluscicide on the national list: given before the National Organic Standards Board. Washington, DC: US Department of Agriculture, Agricultural Marketing Service, 2010. Available at <http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELPRDC5085125>. Accessed November 14, 2012.
- 6) Puritch GS, Almond DS, Matson RM, et al. Ingestible Mollusc Poisons. US Patent 5,437,870. Aug 1, 1995.
- 7) US Environmental Protection Agency. Office of Prevention, Pesticides and Toxic Substances, Office of Pesticide Programs. *Reregistration Eligibility Decision for Metaldehyde*. Washington, DC: US Government Printing Office, 2006.
- 8) US Environmental Protection Agency, Office of Prevention, Pesticides and Toxic Substances, Office of Pesticide Programs. *RED Amendment for Metaldehyde: Labeling Changes for Products Containing Metaldehyde*. Washington, DC: US Government Printing Office, 2007.
- 9) Albretson JC. Iron. In: Plumlee KH, Ed. *Clinical Veterinary Toxicology*; St. Louis, MO: Mosby Inc, 2004:202-204.
- 10) Hall JO. Iron. In: Peterson, ME, Talcott, PA, Eds. *Small Animal Toxicology*, 2nd ed. St. Louis, MO: Elsevier Saunders, 2006:777-784.

REGULATORY TRANSITION

In 2006, the US Environmental Protection Agency (EPA) re-registered metaldehyde. In doing so, they required new label statements intended to reduce the incidence of accidental exposure to children and pets.⁷ In addition to new precautionary statements, manufacturers were required to include a label graphic showing the words “children” and “pets” within a red circle crossed by a slash mark.⁸ For products containing metaldehyde intended for use in residential settings, schools, and similar locations, labels must now include language on the front panel requiring that children and pets are to be excluded from the treated areas until the applied product is no longer visible.⁹

IRON TOXICOSIS

Stage	Time after ingestion	Manifestation of clinical signs ^{9,10}
1	0-6 hours	Damage to the gastric mucosa, signs of depression, abdominal pain, vomiting and diarrhea
2	6-24 hours	Apparent recovery, increased alertness
3	12-96 hours	Return of gastrointestinal (GI) signs, weakness, shock, GI hemorrhage, tachycardia, cardiovascular collapse, coagulation disorders, and possibly death
4	2-6 weeks	Repair of gastrointestinal injury results in obstruction secondary to fibrosis; not as common as stages 1-3

INCIDENTS REPORTED TO THE NATIONAL PESTICIDE INFORMATION CENTER

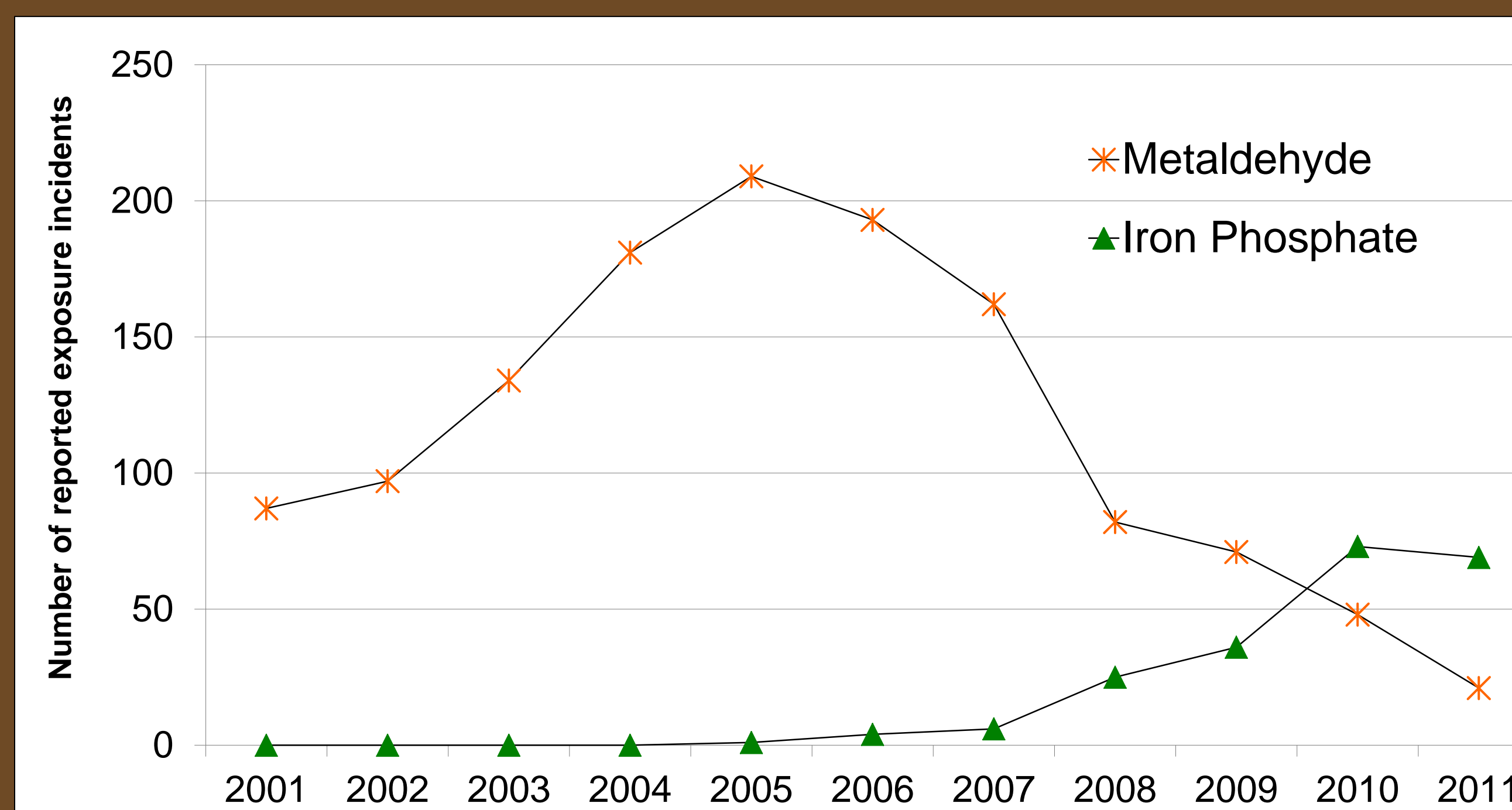


Figure 2. Molluscicide animal exposure incidents reported to the NPIC

Between 2001 and 2011, the NPIC received 1,285 reports of metaldehyde exposure incidents in animals. Although not tested statistically, an apparent increase in the number of reports was observed each year between 2001 and 2005, followed by decreasing numbers each year thereafter (Figure 2). During the same 11-year period, 215 reports involving iron phosphate exposure incidents were received, and the majority of these (195 [91%]) involved dogs. Most (179 [83%]) reports of iron phosphate exposure were received between 2009 and 2011.

1,500 molluscicide animal exposures reported in eleven years:

- 81% (1217/1500) of reports came from west coast states.
- Reports were received from the general public and 76 veterinarians.
- 1,285 reports involved metaldehyde, including 35 canine deaths.
- 215 reports involved iron phosphate with no canine deaths.
- Animals exposed to metaldehyde were asymptomatic 53% of the time.
- Animals exposed to iron phosphate were asymptomatic 60% of the time.
- In 90% (549/610) of symptomatic metaldehyde cases, signs were consistent with published reports about metaldehyde toxicosis.
- In 69% (59/85) of symptomatic iron phosphate cases, signs were consistent with published reports about iron toxicosis.

In the second part of the study, we completed a more detailed review of reports involving canine iron phosphate exposures where clinical signs were compatible with toxicosis.^{9,10}

56 cases involving 61 dogs with signs compatible with iron toxicosis:

- Vomiting was the most commonly reported clinical sign (43/61 dogs).
- Diarrhea was reported for 24/61 dogs, and lethargy for 15/61 dogs.
- These signs were reported in varying combinations for 21/61 dogs.
- Detection of blood in vomit (3) or diarrhea (4) was occasionally noted.
- Exposures occurred after application in 31 (55%) reports, when the product was being stored in 11 (20%) reports, or in the product application staging area in 5 (9%) reports.
- The median weight of dogs was 16.0 lbs (range 3 – 90 lbs).
- The median age of dogs was 3.0 years (range 3 months – 15 years).
- 33 (54%) were female; 23 (38%) were male; 5 (8%) were unknown.
- 26 (43%) of the dogs were Toy breeds or described as ‘miniature.’
- 43/56 (77%) of these reports were submitted by the pet owner, and 13 (23%) were submitted by veterinary professionals.
- Most (44 [79%]) reports originated from west coast states, including California (30), Oregon (8), and Washington (6).
- Two products were involved in all reports with documented product information (77% of reports), and each contains 1% iron phosphate.
- In 8 of these reports, the person calling expressed concern about language on the label implying that the product could be safely used around pets.

CONCLUSION

New precautionary language for metaldehyde product labels, required by the EPA beginning in 2006-7, may have contributed to the apparent decrease in the number of exposure incidents reported to NPIC beginning in 2006. Although no dog deaths were reported following iron phosphate exposure in the present study, **pet owners and veterinarians should be aware of the potential for iron toxicosis from this type of exposure.** In dogs, the clinical signs appear similar to those described following more common iron exposures from dietary supplements and fertilizers.